STUDENT PROJECT REPORT TO THE UNIVERSITY OF HAWAII MARINE OPTION PROGRAM

A study of the pre and post natal care of the captive bottlenose dolphins (*Tursiops truncatus*) at Dolphin Quest, Waikoloa, Hawaii

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* Photo provided by Dolphin Quest

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Introduction

This past summer I participated in an internship at Dolphin Quest on the island of Hawaii. Dolphin Quest is a privately owned company that operates interactive dolphin programs out of the Hilton Waikoloa Village. This hotel (fig. 1) is a lush resort on the Kohala coast, just north of Kona. Formerly the Hyatt Regency Waikoloa, its 62 acres houses over 1,200 rooms in three main towers. The Dolphin Quest lagoon is located by the hotel's Ocean Tower (Fig. 2).

Dolphin Quest is co-owned and operated by Dr. Jay Sweeney (Fig 3), and Dr. Rae Stone (Fig. 4), two marine mammal veterinarians. Dr. Sweeney is known throughout the world as a leader in the field of aquatic animal medicine and is well published. Dr. Stone is best known for her pioneering work using diagnostic ultrasound for marine mammal health care. The Director of Training and manager of the Waikoloa facility is Bud Krames (fig. 5). His wife, Joanne Krames (fig. 6), is also a co-manager at Dolphin Quest. There are eight other trainers on the Dolphin Quest staff, as well as five photographers/videographers.

Dolphin Quest opened on the Big Island in August of 1988. In March of that year, eight Atlantic Bottlenose Dolphins (*Tursiops truncatus*) were collected off the coast of Florida and transported to the newly constructed facility in Hawaii. Unfortunately, two of these dolphins died as a result of eating a local fish in the lagoon that contained a biotoxin. The presence of this biotoxin in some of the native fish prevents the Dolphin Quest lagoon from being open to the surrounding ocean, which was the original goal of the owners. However, a new Dolphin Quest facility has opened in French Polynesia, on the island of Moorea, that will allow the dolphins there, which

are local, access to the open ocean. This facility is housed in the Moorea Beachcomber Parkroyal Resort.

There are two main forms of bottlenose dolphins (ecotypes) found in the wild. A smaller coastal ecotype is found around inshore waters, and a larger, more robust pelagic ecotype is found in offshore regions. Each are found in tropical and warm temperate waters throughout the world in groups of up to more than 1000 individuals. The coastal Atlantic Bottlenose Dolphin is the type usually found in captivity. In the wild they mainly stay around shallow lagoons, and only move out of their relatively small home areas if food becomes scarce. They travel in social groups that appear to be relatively fluid in composition, with many constantly going from one group to another. There are, however, typical patterns in the structures of these groups. Dolphins tend to travel in groups made up of their peers of the same sex. Pregnant females tend to herd together, as do groups of mothers with calves. When the calves get older they leave their maternal groups and form their own sub-adult groups, consisting of juveniles of both sexes. The young dolphins will stay in these groups until they become sexually mature. Some, mostly males, go off on their own to seek mates, others continue to stay in groups and roam together (Thompson and Wilson, 1994).

The Waikoloa Dolphin Quest lagoon is a 25,000 sq. ft. tidal lagoon that holds about 2 million gallons of sea water which is filtered from the adjacent ocean through a porous lava rock wall at a rate of about 10,000 gallons per minute, thus insuring a continuous supply of fresh, clear water. The lagoon has a sandy bottomed shallows where the dolphins can slide up on the shore to rest or check out the people on the beach (fig. 8). This leads out to a rocky bottomed area that reaches about twenty feet in depth (fig. 9). Next to the main lagoon are two holding pens, used to separate any dolphins from the

main lagoon when necessary. A nursing pen was also constructed in the back of the lagoon but wasn't in use while I was there.

My Internship

I started my internship on June 1, 1994. I was the first to arrive of the six interns from across the country scheduled to be there throughout the summer. The reason for so many interns was because all four of the female dolphins (Shaka, Pele, Leilani, and Kona) were pregnant for the first time, and student interns were needed to help out with the pre and post-natal care and observations of the females and their calves. We all stayed at a Dolphin Quest-leased house in Waikoloa, about seven miles from the hotel.

For the first two weeks I was the only intern present. During this period I spent most of my time becoming familiar with the staff, the programs, and the dolphins themselves. The latter would become particularly important later in the summer when most of my time would be spent recording various behavioral observations of the individual dolphins and their calves. It was vital that each dolphin could immediately be correctly identified, even under less than perfect viewing conditions. For the first week or so I spent at least an hour or two every day learning to tell the dolphins apart by their various characteristic markings. These include various scars and tooth-rakes on the body (obtained during play and sexual behavior), notches and scars on the flukes and fins, overall body shape and coloration, and facial features.

Among the females, Pele was the shortest and stockiest with a short rostrum. Leilani was the longest and most streamlined with the longest

rostrum. Kona was the most evenly proportioned and had the pinkest coloration on her underside and rostrum. Shaka had a distinct yellowish, turned-up rostrum. As for the boys, Hobi, the dominant male, was the largest and had a big head and big eyes. He had just become sexually mature a year ago and subsequently sired all four calves. Both male and female bottlenose dolphins become sexually mature between the ages of five and twelve (Anderson, 1969). The animals at Dolphin Quest were all about nine years old when I was there. Lono, the other male, was not yet sexually mature. He had more scratches and tooth-rakes on his body than any of the other dolphins.

One activity that helped me to tell the dolphins apart was taking respiration rates. This involved picking out one of the dolphins and counting how many times it surfaced to take a breath over a five minute time interval. The respiration rates of the female dolphins were taken a few times a day prior to parturition so that any inconsistencies could be detected. During the first couple weeks of my internship, various staff members would point at a dolphin and ask me to identify it until I consistently answered correctly.

The working day at Dolphin Quest starts at 8:15 AM. After listening to any announcements, one or two of us would prepare the day's fish. Bottlenose dolphins eat between three and six percent of their body weight each day in fish, cephalopods, and occasionally crustaceans (Thompson and Wilson, 1994). When I first arrived, these dolphins were each eating about 25 lbs. of food a day, consisting of a mix of herring, capelin, mackerel, and squid which they were continualy fed throughout the working day Lactating dolphins will as much as double their daily intake (Lockley, 1969). When I left, the mothers were eating between 30 and 35 lbs. a day.

Dolphin Quest Programs

The activities at Dolphin Quest are centered around the six or so daily interactive encounters. Dolphin Discovery is a program for children between the ages of six and twelve that allows them to learn about these creatures first hand through a shallow water encounter. The teen program (for thirteen-nineteen year-olds) is similar but geared towards students. Dolphin Doubles is a shallow water encounter for pairs of guests over the age of sixteen.

Another dolphin encounter in which guests thirteen years of age or older can swim in the lagoon with the dolphins wearing masks and life-jackets, was not offered during the time of my internship due to the pregnancies and births. Before the births, all programs were limited to shallow water encounters by the beach. After the births, they were mostly limited to the dockside holding pens where the males were kept. They were isolated from the mothers and calves to prevent any possible harsh or aggressive interactions that might harm the calves during their first vulnerable weeks. They were kept in the pens from the time of the births until just after I had left. The adult encounters taking place after the births did start to allow the guests to observe the mothers and calves from the shallows with masks.

Dolphin Quest also sponsors educational seminars for school children and educators. They are also involved with the Make-a-Wish Foundation that offers children with life threatening diseases the chance to fulfill some personal desire. Many of these children request an opportunity to swim with dolphins, and Dolphin Quest accommodates them with a private, one-on-one encounter session (figs. 10-12).

The dolphin encounters are so popular at the hotel that space to participate in them is determined by a lottery system. The guests chosen for the next

day's programs are broadcasted on the hotel's in-house television channel. The dolphins chosen to participate in the various programs are determined by how they are acting, and who is working well with whom lately. If a dolphin isn't showing any interest in a program, they are not forced to perform, but rather are left alone while the remaining dolphin or dolphins continue on. The pregnant dolphins continued to participate in the programs up until the time they gave birth.

The encounters start off on the beach where the guests don life-jackets and gather at the water's edge for a brief introduction. They then break up into groups of four or five each and move into the water for more personal contact with the dolphins (fig. 13). One of these groups is always video-taped for people wishing to purchase a video of their encounter. Also, another photographer goes between the groups and shoots still photographs of each guest with the dolphins, which are also available for purchase.

Throughout the programs, the dolphins perform various trained behaviors (figs. 14 and 15), and are rewarded with fish and positive tactile reinforcement from both the trainers and guests. At the end of the encounters, the guests are gathered together once again at the water's edge to go over what they've learned and to get a few last minute tips on marine wildlife conservation. As they leave, they are handed various written conservation material from a volunteer representative of the Waikoloa Marine Life Fund, a non-profit organization created by Dolphin Quest to which a portion of the proceeds from each encounter goes to help sponsor various research projects. These projects include a Hawaiian Monk Seal study conducted by researchers at the University of Hawaii, a Hawaiian Spinner Dolphin research project, a bottlenose dolphin signature whistle study conducted by Dr. Peter Tyack of the Woods Hole Oceanographic Institution,

and a program to protect the Vaquita, an endangered porpoise in the upper Gulf of California. The Waikoloa Marine Life Fund also sponsored a two hour educational class for young children this past summer that the interns helped run.

Pre-natal Care

We interns also got a chance to observe and help out when Dr. Stone did her ultrasound examinations on the mothers-to-be. The dolphins would swim up to the dock where one person would support its head and upper thorax region, and another its peduncle region, while Dr. Stone conducted the exam. She used a portable ultrasound machine, the same type used for humans. The sensor was pressed against the dolphin's abdomen while she monitored and recorded the image through a camcorder. The picture produced was a monochrome image roughly in the shape of a triangle that showed the interior of the womb. Figures 16-21 show some of the ultrasound images taken at various stages of development.

The dolphins seemed to enjoy the tactile stimulation of the exams. Dr. Stone even did some pseudo-examinations on the two males so they wouldn't feel left out. She has compiled the most complete fetal development record of bottlenose dolphins to date and plans to publish her work. Pregnancy was detected in these dolphins when the fetuses were around six weeks old. Ultrasonography and the determination of blood hormone levels are two recently improved veterinary techniques that now allow for early detection of pregnancy in captive marine mammals and have already resulted in more full-term births of dolphins at some facilities (Williamson, et. al. 1990).

Once the pregnancies were detected, the females were trained on proper nursing techniques. Dolphins in the wild usually learn this type of behavior by watching other dolphins nurse. However, since these dolphins were collected when they were relatively young (about three years old), they might not have had the chance to properly absorb the techniques. They were therefore trained to roll over and present their mammaries to a miniature dolphin doll when it was thrown into the water. Trainers also used a small dolphin puppet to simulate a young dolphin suckling so that they might become familiar with the sensation (fig. 22).

Reproductive Biology

As the pregnancies advanced, it became increasingly apparent in the physical appearance of the dolphins. For one thing, like other mammals, their abdomens became more extended (fig. 23). Also, the uro-genital region of pregnant dolphins becomes more wrinkled and swollen the closer they came to term (fig. 24), with mammary gland development occurring around the seventh month of pregnancy (McBride and Kritzler, 1951).

Dolphins, like humans, are also susceptible to false labor contractions in late pregnancy. These contractions are characterized by straining and flexing the body, along with labored respiration (Williamson et. al. 1990). Shaka started demonstrating these characteristics more than a month before she actually gave birth. Everybody expected her to be the first to go into labor, when in fact she was the last. It was a standing joke among the staff that she wasn't really pregnant, only faking it to get some attention.

There is a twelve month gestation period for both captive and wild bottlenose dolphins, and females tend to give birth every two or three years (Anderson, 1969). This is a relatively long period of gestation for a carnivorous mammal and has probably been adapted for reasons similar to those of the larger herbivorous animals from which they evolved. Young ungulates must be able to follow their mothers as they move from one pasture to another within a short time after birth. In a similar fashion, young dolphins, unlike terrestrial carnivores which may lie helpless in a den, must be able to swim with their mothers from the moment of birth. The long gestation period therefore gives dolphins the developmental time necessary for survival (McBride and Kritzler, 1951).

In captivity, calves can be born in any month of the year, whereas births in the wild usually occur within particular seasons which vary between populations and have probably evolved in each area to avoid times when predators are abundant or when food is in short supply (Thompson and Wilson, 1994). In captivity, male dolphins of several different species often attempt to mate with other dolphins, male or female, of another species, genus, or even family. Occasionally these cross-matings have resulted in offspring, even when the parents were members of different families. In the wild, however, it is unlikely that such practices, if they occur at all, would produce viable offspring (Harrison and Bryden, 1988).

Sexual intromission among captive bottlenose dolphins generally lasts between two and twenty seconds. The male swims up beneath the female and they mate with their bodies more or less at right angles to one another. The male's penis is coiled or curved within its sheath and has a hook-like shape when erect. A pair of strap-like retractor muscles are responsible for holding the penis in place. In most mammals, the penis is mostly made up of three

columns of spongy tissue, and erection occurs when they fill with blood. The dolphin's penis contains these three columns, but they are not very spongy and instead contain a relatively large amount of tough, fibrous tissue. Erection then occurs when the retractor muscles relax.

The testes are elongated in shape and lie within the abdominal cavity just behind the kidneys, rather than in an external scrotum as is the case with most other mammals but which would be quite detrimental to the dolphin's streamlined body form. The testes of an immature dolphin are only an inch or so long and weigh about twenty grams. At puberty, however, they increase dramatically to as much as two feet in length and several kilograms in weight (Harrison and Bryden, 1988). Figure 25 shows a diagram of the male reproductive organs.

The anatomy of the female reproductive organs is similar to that of most other mammalian species. The uterus is made up of a body and two horns which narrow at their ends to form the uterine tubes. These lead to the ovaries, which lie in the abdominal cavity behind the kidneys, similar in position to the male's testes. Mature ovaries contain egg cells (oocytes) surrounded by other cells to form follicles. Ovulation occurs when one of these follicles enlarges and bursts, releasing the oocyte which is drawn unto the uterine tube. The cells remaining in the collapsed follicle after ovulation multiply and form a large grey or yellowish structure, the corpus luteum. If the oocyte is not fertilized, the corpus luteum degenerates. If fertilization does occur, the corpus luteum remains in fact until the end of the pregnancy. In either case, the degenerated corpus luteum turns white and is called the corpus albicans. One unique characteristic among Cetaceans is that their corpora albicantia are present throughout an animal's life, providing a record of past ovulations from which one can estimate how many pregnancies a

particular individual has had. Fetuses of bottlenose dolphins typically develop in the left horn of the uterus, so reproductive history would be revealed by the left ovary (Harrison and Bryden, 1988). Figure 26 shows a diagram of the female reproductive organs.

Paturation

When Dolphins are ready to give birth, they usually stop eating about 24-48 hours before labor sets in (Norris, 1966). The Waikoloa dolphins were no exception, and all stopped taking food about a day before they gave birth. The first to go into labor was Pele. Most dolphins in captivity give birth at night (Lacave, 1991). Once again these dolphins went along with the normal trend, each giving birth within an hour or two of midnight. Pele's calf, the big island's first captive-born dolphin, was born at 10:50 PM on June 30. Unfortunately, I was on the other side of the island and didn't get to witness the birth. Her labor lasted about two hours and twenty minutes, a little on the long side for a successful birth. According to Dr. Stone, most live births occur in under two hours and anything more usually signifies complications. In many instances it is not so much the actual time consumed that determines success or failure, as whether or not the fetus is speedily expelled once the posterior portion of its trunk is free and the umbilical cord is stretched taut (McBride and Kritzler, 1951). The labor of each of the other dolphins took between one and two hours.

Pele and her calf underwent some other complications as well. Like humans, some dolphins are good mothers and others aren't. Unfortunately, Pele wasn't as good as we hoped she would be. She didn't keep her calf under

control as well as she might have at first, and the calf bumped into a couple of things upon straying. At one point, the calf ended up on the beach and had to be removed and given oxygen. It was then discovered that the calf was a girl. When she was placed back into the lagoon, she seemed to be doing better and Pele kept more control of her.

However, another aspect that didn't go very well was the nursing factor. Dolphin calves should start nursing from their mothers within hours after birth (Peddemors et. al., 1992). Unfortunately, Pele and her calf never got together properly for suckling to occur. Either the calf didn't respond when Pele tried to present herself, or Pele didn't properly present herself when the calf nudged her mammary region. The Dolphin Quest staff was prepared for this type of situation and had formula on hand. The calf, however, died at 6:00 AM on the morning that hand-feeding was going to be attempted. She was two days old. The necropsy performed by Dr. Sweeney revealed that she had developed a blood clot in the brain from the injuries she had earlier sustained (fig. 27).

The next couple days were sobering ones for the staff. Of course they knew it was unlikely that all the calves would survive, but after spending a year preparing for the births, having the first one die was quite disappointing to say the least. Dolphins born in the wild only have about a 50% survival rate, and with first time mothers the rate drops to about 15% (Coffey, 1977). It was hoped, however, that these odds would be greatly improved with the training and medical care the dolphins had been receiving. In addition to the periodic ultrasound examinations, blood (Fig. 28), blow, fecal, urine, and stomach (Fig. 29) samples were regularly taken from each of the dolphins as part of their routine medical care.

Spirits picked up on the Fourth of July when Kona went into labor and gave birth to a healthy baby boy. I was in the water with a mask on during her labor and was able to witness the birth. We were all positioned around the lagoon so that we could prevent the calf from running into anything or beaching itself when it first came out. It seems that although dolphin calves are strong swimmers, they can't always maneuver very well on their own. Kona proved to be a very good mother though, and took control of the calf right from the start.

The calves of all toothed whales (Odontoceti) are born tail first (Coffey, 1977). As soon as the baby's flukes came out of Kona, we all took our positions around the lagoon. Her labor lasted about an hour and a half. The whole process was incredible to watch, she was just swimming around with this baby sticking halfway out of her. Occasionally she would go over to the shallows and rub her body on the sandy floor. She also rubbed herself against the person in Scuba gear that was video-taping the birth. She was very affectionate with the training staff, frequently swimming over to the dock to be rubbed down and soothed.

Eventually, after a big push, the baby came out in a puff of fluid. When dolphin mothers expel their fetuses, they spin around rapidly to face the calf. This allows the umbilical cord to snap and also brings the mother into a position where she is able to help the calf get to the surface should it become necessary. Most calves, however, are able to surface for their first breath on their own (McBride and Kritzler, 1951).

Kona did better than Pele not only in controlling her calf, but nursing it as well. The morning after the birth we noticed that the baby was suckling. We were also able to see the milk on occasion, which verified that the calf was indeed feeding. By this time, the trainers had taken some milk samples from

Pele with a breast pump (fig. 30) just in case any of the other calves needed to be hand-fed.

Leilani's calf was the next born. I was on the beach while she gave birth to her boy, and entered the water immediately after. Lastly, Shaka's boy was born. I was in the water for the last half of her labor, and got to witness her delivery as well.

Physiology of Newborn Dolphins

Bottlenose dolphin calves are about a meter long and weigh about 25 lbs. at birth (Anderson, 1969). These weights and measurements are usually estimated because infant dolphins are very delicate and succumb rapidly to "capture shock" if they are handled before six months of age (Lacave, 1991). The Dolphin Quest policy is therefore to leave the calves alone until this time unless some sort of emergency arises.

Newborn dolphins are more pale than the adults and have several (usually six) even paler transverse bands evenly spaced along both sides of the trunk from the posterior insertion of the pectoral fins to the anus. These creases are between 1.5 and 2 cm wide and about 8 cm apart. The bands are thought to be folds resulting from the bending of the fetus when it lies doubled up in the uterine horn. They fade away at around six weeks of age (Kastelain et. al. 1990). Around that time is also when the teeth start to develop. Bottlenose dolphins have about 44 conical teeth on both their upper and lower jaws (May, 1990).

Also present on the newborns is a single row of seven or eight curled hairs (vibrissae) on each side of the rostrum. This mustache is lost before the

dolphins are a month old, but the follicles are evident throughout their lives (Thompson and Wilson, 1994). At birth, the dorsal fin is soft and curls to the right. This temporary curling is a result of in-utero folding. The fins and flukes straighten up and stiffen during the first two weeks of post-natal development (Coffey, 1977).

The eyes are open at birth and vision seems to be good. All Cetaceans have strong muscles around their eyes that can change the shape of the lens to accommodate either air or underwater vision. Their hearing seems to be functional at birth as well. Dolphins have small ear holes 2-3 mm in diameter that are located about 5 or 6 cm behind their eyes (Harrison and Bryden, 1988).

Dolphin Vocalizations

Each bottlenose dolphin has its own distinct signature whistle that differs from that of any other (Thompson and Wilson, 1994). The whistles start as a high-pitched note that quickly rises out of our hearing range, and then drops back down in pitch at the end. These high pitched calls can be easily heard above the lower background noises of their underwater world. When calves are first born, their mothers will repeat their signature whistle over and over so that the calves will recognize it and be able to find them easily. Female calves are capable of making their signature whistles at birth. Males, however, need to develop theirs over time. These whistles enable the mother and calf to remain in close contact by calling to each other periodically. Their mutual recognition of each other is based on sound rather than smell, as is the

case for most terrestrial animals. Communicative vocalizations like these are produced from the dolphin's blowhole.

The other type of sounds that dolphins produce are echolocation clicks that act as a sonar sensory system. The organs used for this sixth sense are made up of deposits of a special type of fat in the forehead and lower jaw regions (Harrison and Bryden, 1988). The head fat organ (melon) focuses the internally produced clicks into a directional beam that projects out in front of the dolphin. The sound waves bounce off the objects in their path and the reflected echoes are received by the lower jaw and transmitted through its fat organ to the middle ear, and subsequently to the brain for processing and interpretation. The amount and pitch of the sound coming in provides information on the nature of the targets. The length of time between the emission of a click and receiving its echo lets the dolphin know how far away the object is. The effective range of the clicks is believed to be at least 800 meters. An echolocating dolphin must wait until the echo of one click is received before it can send out another. Therefore, the closer the dolphin gets to its target, the closer together the clicks start to come until eventually they sound like a continuous creaking. Dolphins use a broad range of frequencies when echolocating, the higher of which give out more detailed information about the objects they encounter. These higher frequencies have an effective range of about 100 meters. Captive dolphins tend to use sound waves of lower intensity than those in open waters, where divers often say they can feel the noises as much as hear them.

Post-natal Observations

The Dolphin Quest lagoon seemed to always be filled with clicks and whistles when we were in the water making out observations. We started recording these observations around the clock once the first baby was born. Dolphin Quest had earlier procured two 2-man observation vessels that floated on top of the water (fig. 7), but these proved to be cumbersome and ineffective because one could only see directly beneath them. Instead, we initially had one person observing from the water by the nursing pen with a mask on, and another atop a scaffolding structure that had been erected on the beach. Later, the person on the scaffolding was moved down to the dock to be in closer communication with the person in the water. At night, there were one or two people on the dock, mainly just to take make sure the dolphins were doing alright, not necessarily to take detailed notes.

The baby dolphins would stick close to their mothers, usually swimming in a position beside their dorsal fins (fig. 31). This lets the calves save energy by riding the mother's bow wave. It also blends the two's color patterns together somewhat, making non-captive calves less obvious to visual predators (Norris, 1966). Mother dolphins are very attentive of their calves, keeping them close and retrieving them if they stray, often punishing them as a lesson. Punishment often involves either holding the calf underwater and preventing it from surfacing, or pushing the calf out of the water with her snout or flippers. The mothers also prevent the calves from approaching new objects, people, or other adult dolphins (Navarro, 1990).

Usually, however, some sort of "auntie" evolves into the social order that will occasionally help the mother with her calf. They may assist the mother during labor (fig. 32), or help watch over the calves while the mother

is feeding or needs a break (Coffey, 1977). Other females were present in the Dolphin Quest lagoon when each of the mothers gave birth, and afterwards as well. During each's labor, however, they pretty much kept to themselves, and were fairly protective of their calves afterwards. Occasionally one of the females without a calf would try to steal one away from its mother, but usually to no avail. Towards the end of my stay, however, Pele did start to take on the occasional auntie role. As the calves get older it can be expected that they will spend less time with their mothers and more with each other and the other adults (Chirighin, 1987).

The main reason that the calves need to constantly be with their mothers at first, is so that they may develop an efficient nursing pattern. Keeping track of this pattern was our primary observational task. We would note which mammary the calf was suckling from, the length of the suckle, and the time each took place. We also made note of any fecal excretions from the calves, which verified that the nursing was indeed effective.

A dolphin's two mammary glands open into a pair of sacs on either side of the anal opening. A suckling calf will insert its beak into the opening of one of the sacs and grasp the nipple between its upper jaw and tongue. The edges of the calf's tongue are fimbriated to ensure a water-tight seal. Muscular contractions from the mother squirt the milk into the calf's mouth (Eastcott and Dickinson, 1987).

We observed several consistent nursing behavior patterns demonstrated by the mothers and calves early on. Nursing was often initiated by mother or calf through tactile stimulation of the urogenital area on either one of the two. Sometimes the calf would come up and bump the mother's uro-genital region with its head to get her to present herself (fig. 33). Other times, the mother would nudge the same region on the calf with her rostrum to get him to suckle

(fig. 34). Often the calf was in-sync with its mother and glided in as she rolled over to her presentation. Sometimes the mother wouldn't roll over and the infant was forced to roll himself to achieve proper orientation. Usually though, it was a combination of the two. Figures 35 and 36 show the calves nursing.

The babies suckled in bouts that varied in time, but usually lasted about half an hour or a little less. The bouts ranged from one to several suckles with the calf surfacing for air at least once between suckles. The length of each suckle varied between one and several seconds, often lasting up to ten seconds or more.

As calves get older they suckle less frequently. They start to supplement their diet with fish at around six months of age, and gradually increase their solid food intake until weaning. The mother's milk is high in fat (about 15%), but more necessary nutritional energy is provided by the fish (Peddemors et. al., 1992). Calves are usually weaned at around 18 months, but this time varies. Often the mothers will eventually repel their calves' attempts at nursing. Other times milk has been found in the stomachs of adult dolphins, or females have been found to be producing milk several years after giving birth. This suggests that suckling behavior may be used to maintain social bonds (Thompson and Wilson, 1994).

Nursing is also tied in with a calf's respiratory behavior. Suckling times are fairly short because infants need to surface frequently during their first weeks (Lockley, 1979). We took respiration rates for each of the calves around every hour. The first six hours after birth are the most crucial for the calf in gaining respiratory efficiency (Peddemors, 1990). Sometimes the mothers would keep pace with the calves, other times the calves would surface on their own (fig. 37). A newborn's respiratory rate may be as much as

double the adult rate. This is primarily due to the increased heat loss resulting from their need to beat their flukes more rapidly to compensate for their smaller mass. As the calves get older their respiratory rate decreases and suckle times increase (McBride and Kritzler, 1951).

The amount of milk an infant takes in is also limited by the amount of food its mother is eating. Just after the calves were born Leilani's fish in-take dropped way down. We were worried that the baby wasn't getting enough milk and would become critically malnourished. The calf was also spending alot of time with Pele during this period, so its nursing frequency dropped down as well. Fortunately, Leilani got her appetite and her calf back before any decision was made to intervene with an alternative nursing method.

Other than this, everything seemed to go well with the boys while I was there. Kona's calf squeezed through a gate once, and one of them needed to be helped off the beach one night, but nothing major. Apparently there is a superstition about naming a dolphin calf before a reasonable amount of time has passed after parturition and probable survival is indicated. Therefore, naming the boys was held off until after I had left. I have since found out that Kona's calf was called Kuo Koa (Independence), Leilani's is Kolohe (rascal), and Shaka's, Lokahi (stands together).

My Conclusions and Evaluation of the Internship

I learned a lot during my stay at Dolphin Quest and really enjoyed the time I got to spend with the dolphins. I think that most others who visit the facility have the same reaction. Of course, some people believe that this type of program only exploits the animals, and Dolphin Quest and similar organizations have had their share of dissenters (fig. 38). I feel, however, there are many reasons why most of these protests should be disregarded. For one thing, many more dolphins die in the wild each year than have ever been placed in captivity. I also think that most captive dolphins, especially those at prime facilities like Dolphin Quest, lead healthy, stimulating, and enjoyable lives. The dolphins here benefit from having two top-class marine mammal veterinarians on staff, and they receive the best possible medical care. Dr. Stone says the fact that all four females became pregnant at the same time is a sign that they have adjusted well to their environment, and indicates that their social, physiological, and habitat needs are successfully being met. They eat the optimal amount of restaurant quality food every day. They are constantly meeting new people and being fawned upon. Their caretakers love them, and I am sure the feeling is mutual (fig. 39). In fact, everybody they come in contact with gives them aloha. They seem to get along well with each other (figs. 40 and 41), and now babies have joined their family (fig. 42).

Of course their lives are sheltered, but shelter can have good connotations as well. They are protected and pampered, and I'm sure they are happier and more stimulated than most other animals in captive situations. I don't think that the training these animals go through and the programs they participate in are exploitive. Rather, I think they provide the positive stimulation needed to maintain healthy and happy lives. Of course its hard not

to think anthropomorphically about these creatures with their permanent smiles, affectionate nature, and endearing mimicry (fig. 43). Nevertheless, some animals seem to be able to adapt quite well to a captive lifestyle, and bottlenose dolphins are potentially one of these. They are the most common Cetaceans found in captivity for this reason. Also, because they are found close inshore, they are the best-studied Cetaceans in the wild. And even though these particular animals are in captivity, they do have a limited control over their doings in that they can decide whether or not they wish to participate in certain activities. The fact that they almost always do probably indicates that the interactions are indeed enjoyable to them.

Dolphins entering captivity are unquestionably deprived of this carefree lifestyle, but their new role as ambassadors of their species has its challenges and benefits as well. There is no question that we humans have benefited from observing directly these animals that most of us would otherwise never get a chance to see. And with more and more programs becoming increasingly more conservation oriented, we are becoming educated on how to help the brothers and sisters of these mammals in the wild. With programs like Dolphin Quest, we are able to create an effective link between public programs and marine mammal conservation efforts. And the facts are that these animals receive excellent care, lead active social lives, and are protected from predators and pollution by professionals who love and respect them. I feel that such programs should be supported so that we may continue a relationship with marine mammals that will be mutually beneficial.

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Figure 1

The
Hilton Waikoloa Villiage

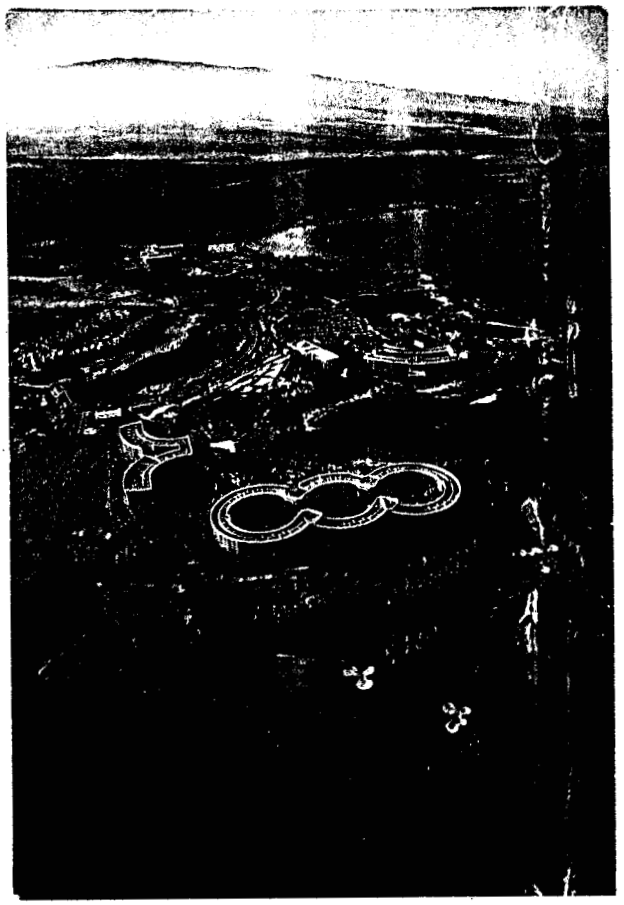


Figure 2

The Ocean Tower
Coastline

Figure 3

Dr. Jay Sweeney

Figure 4

Dr. Rae Stone

Figure 5

Bud Krames

Figure 6

Joanne Krames in the D.Q. office

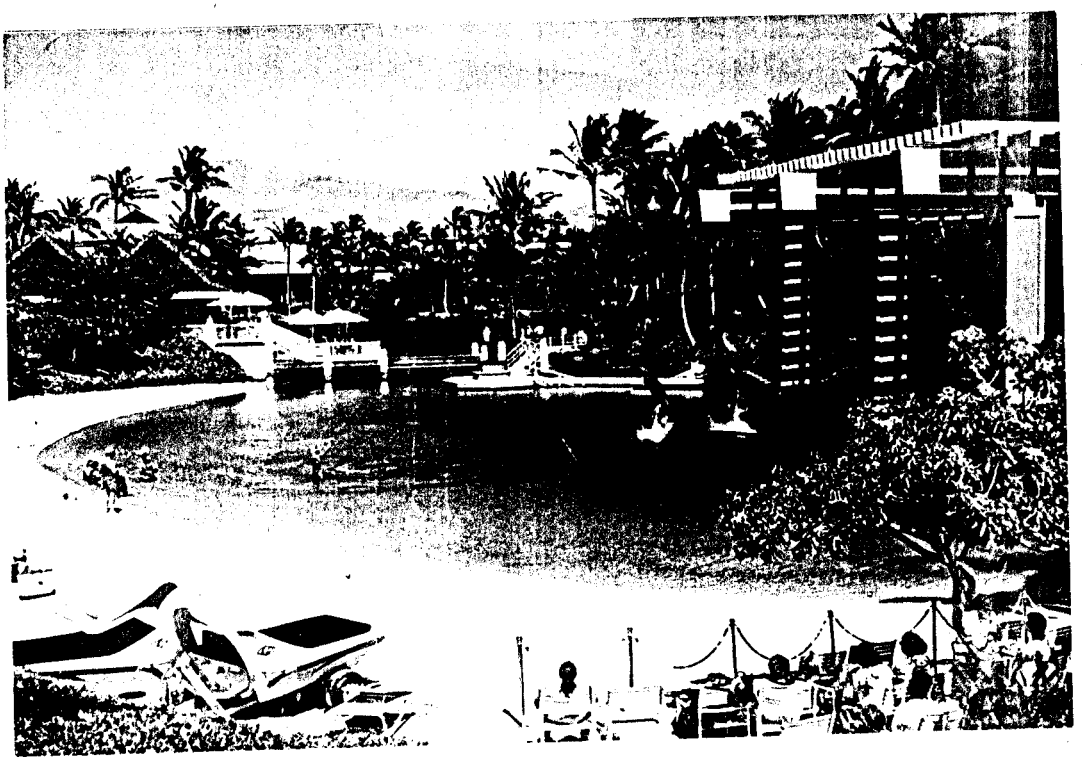


Figure 7

The D.Q. Lagoon

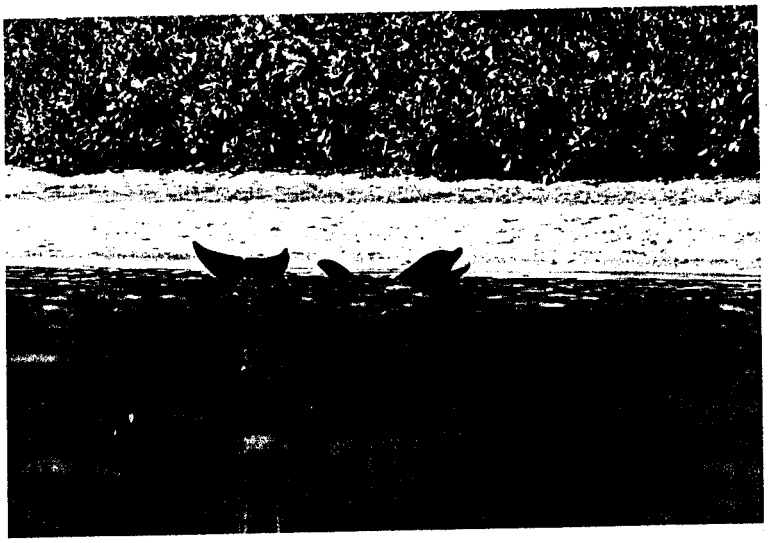


Figure 8

The dolphins often slide up on the beach

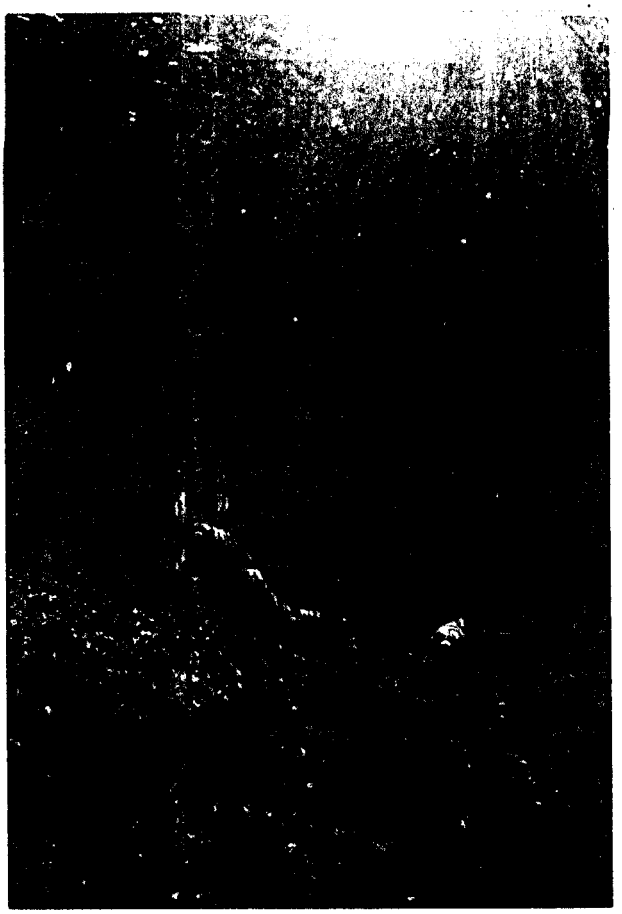


Figure 9

They spend most of their time frolicking in the deeper area

Figure 11

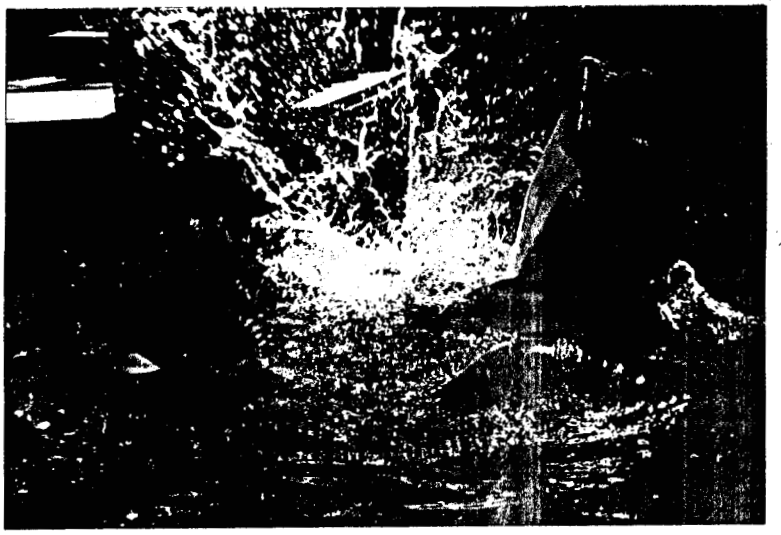


Figure 10

Figure 12

Children are given
personal encounters
through the
Make-A-Wish Foundation

Figure 13

A typical shallow water encounter

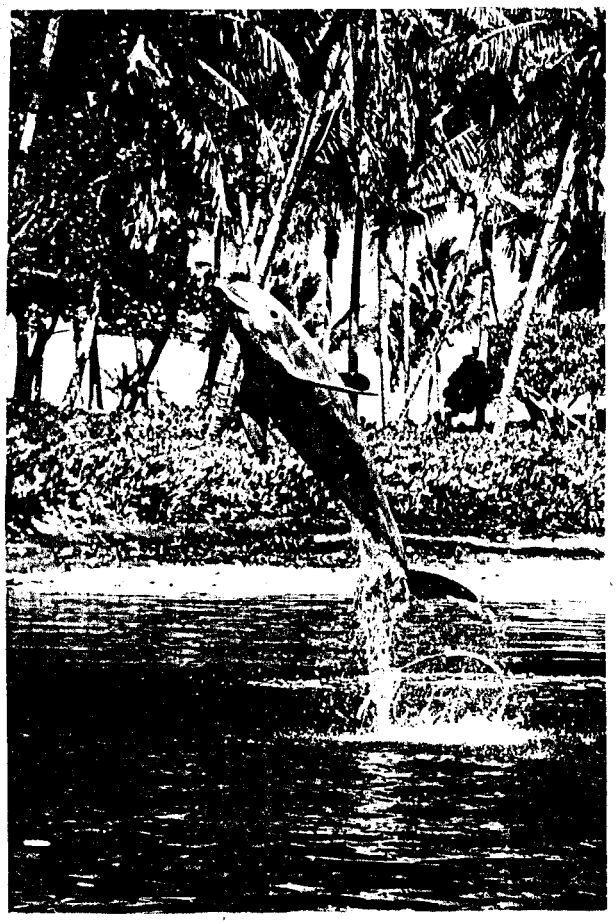


Figure 14

Jumping
through a hoop

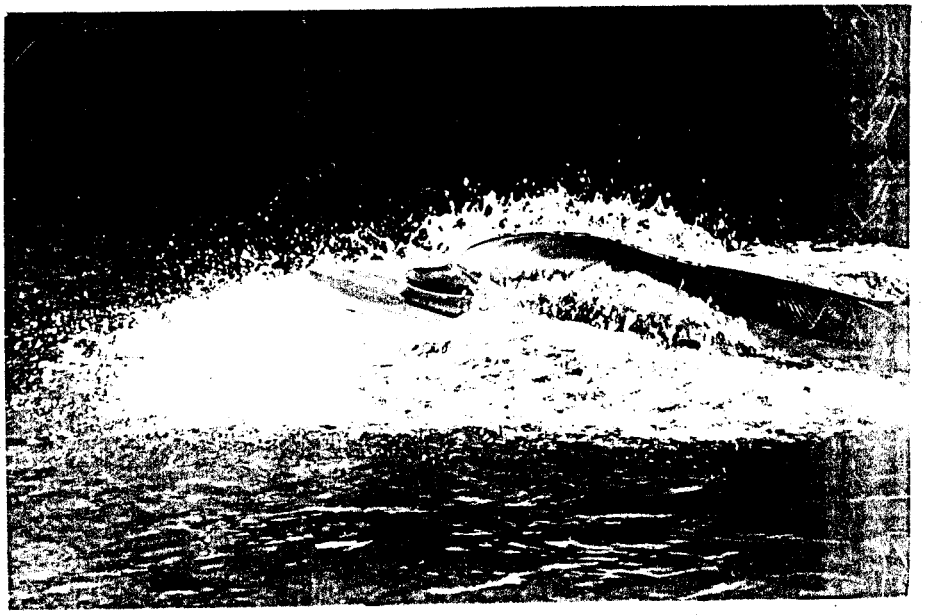


Figure 15

Surfing

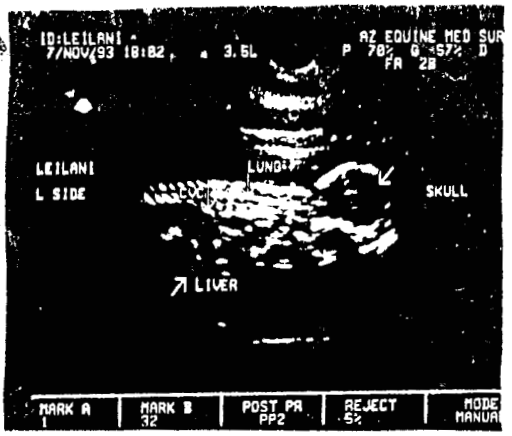


Figure 16: 5 months

Figure 17: 6 months

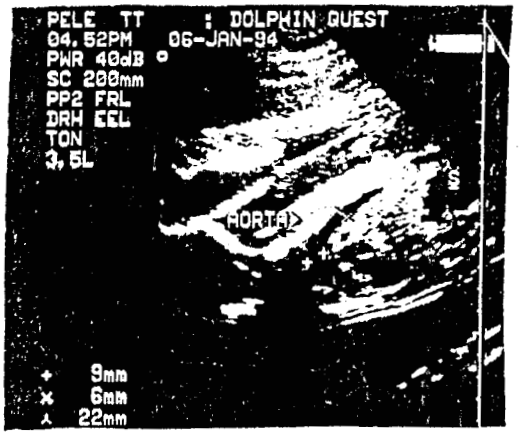


Figure 18: 7 months

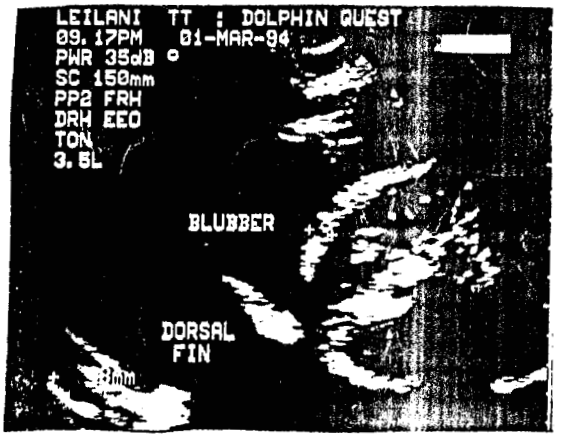


Figure 19: 9 months

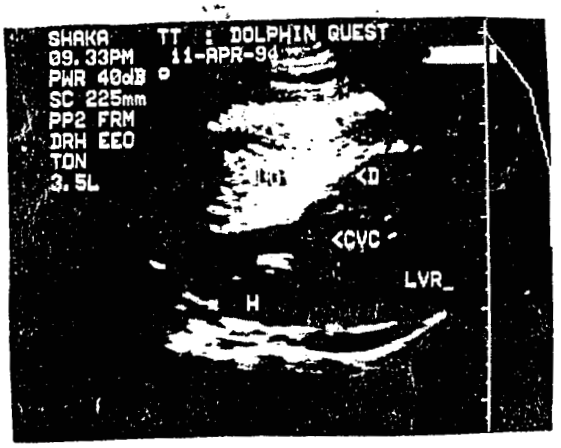


Figure 20: 10 months

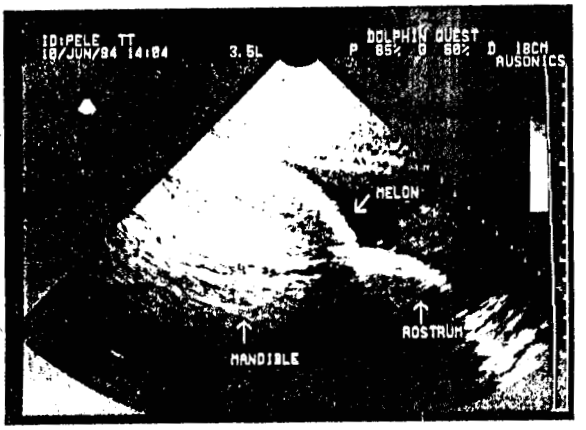


Figure 21: 12 months

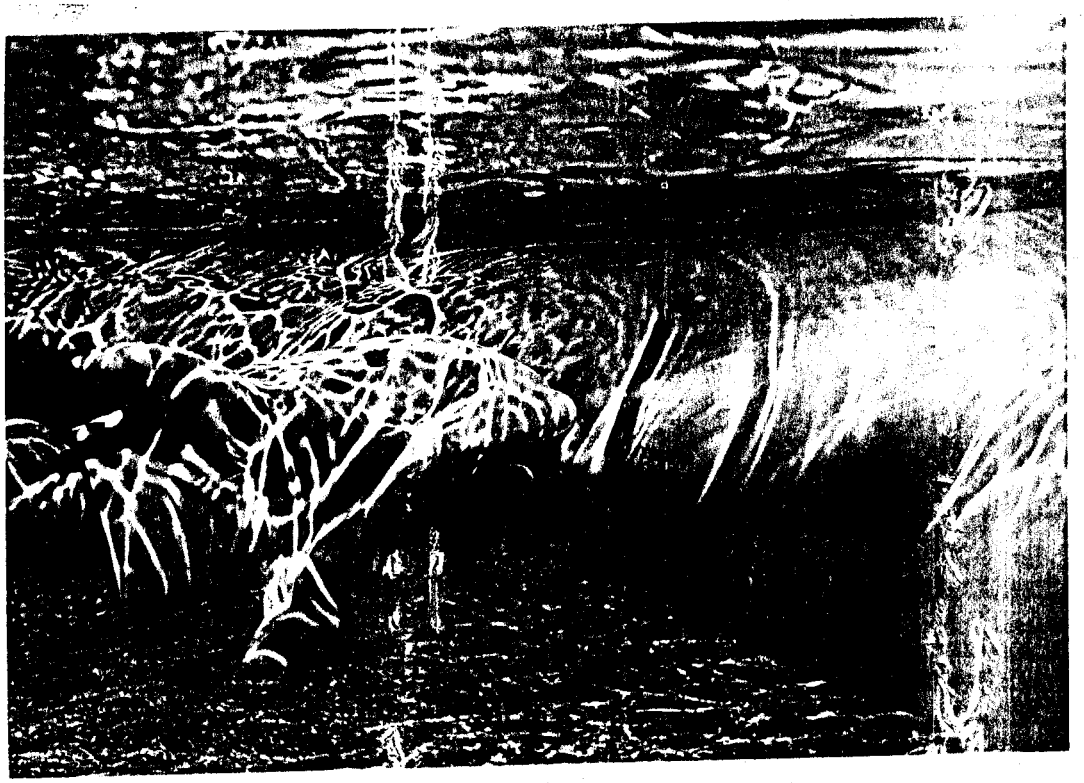


Figure 22

Using a puppet to simulate nursing

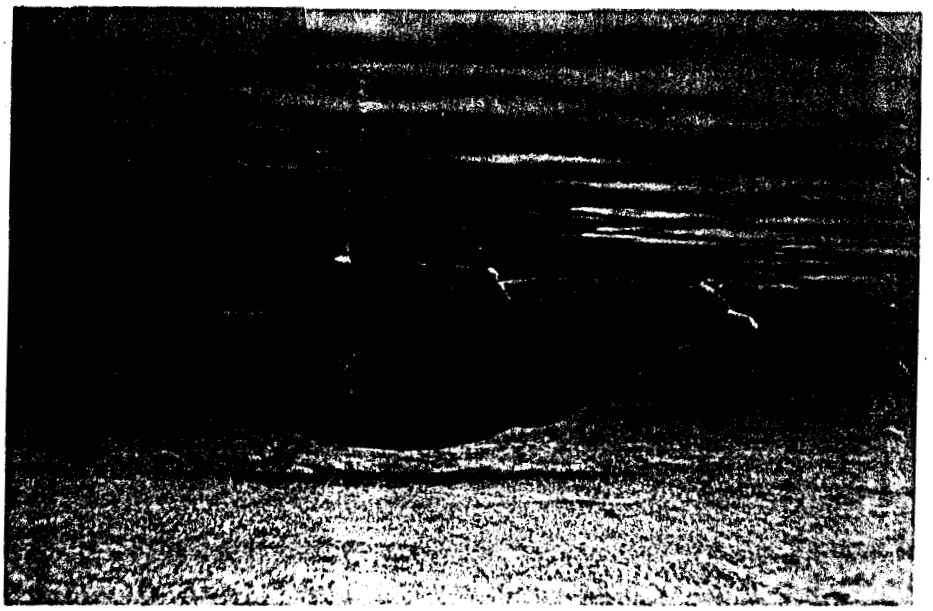


Figure 23

Yes, this is a pregnant dolphin

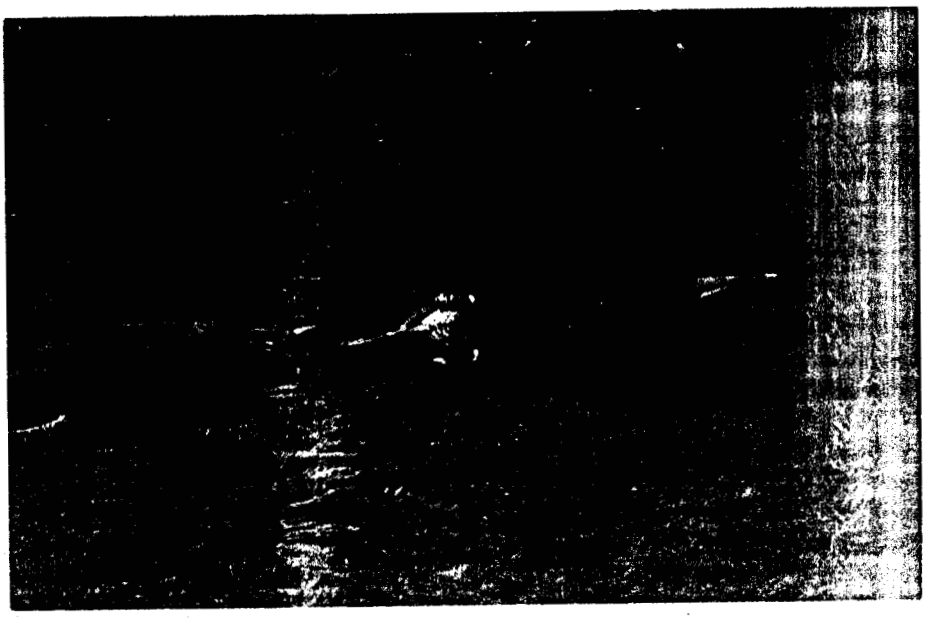


Figure 27

Pele with her calf
(note the baby's scraped-up head)

Figure 28

Blood samples are taken from the flukes

Figure 29

Stomach samples are taken with a suction tube and tested for micro-organisms

Figure 30

Milk samples were collected from Pele with a breast pump

Figure 31

The calves usually swim
by their mother's side

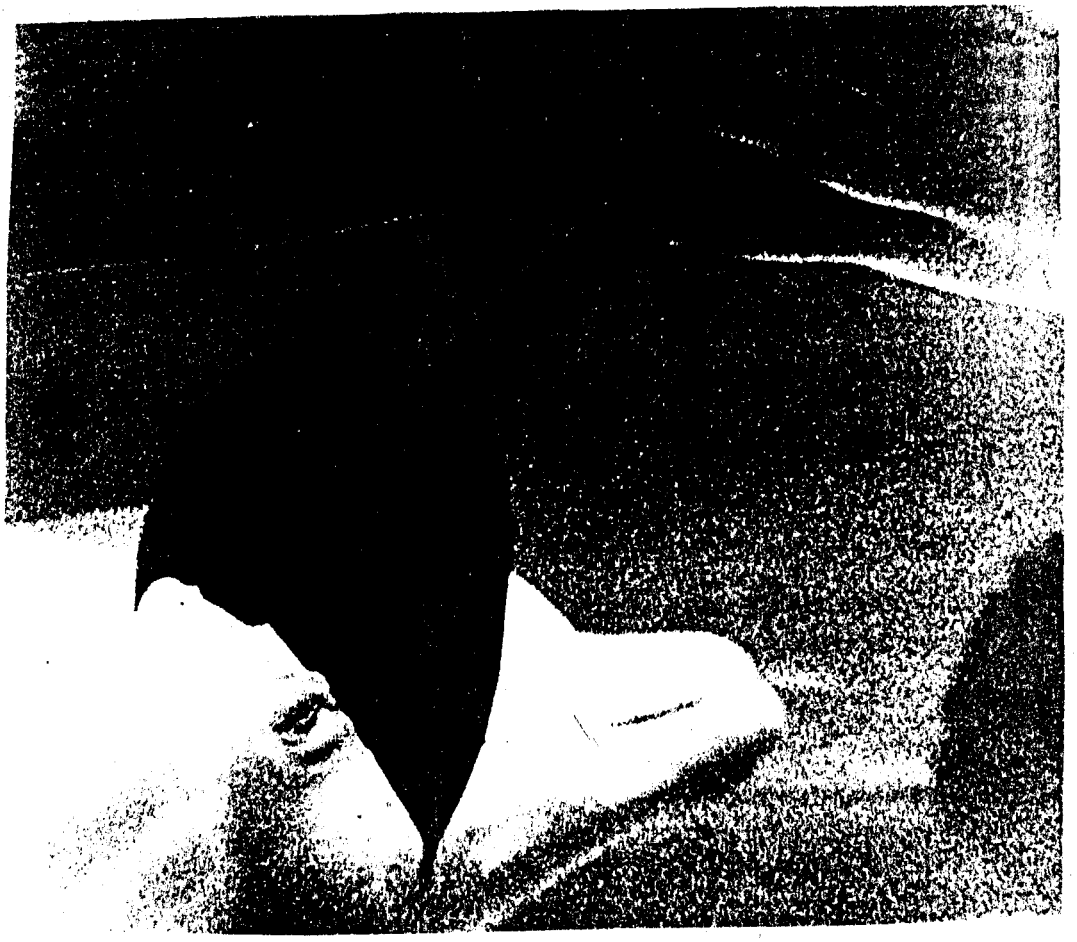


Figure 32

Often "aunties" act as mid-wives

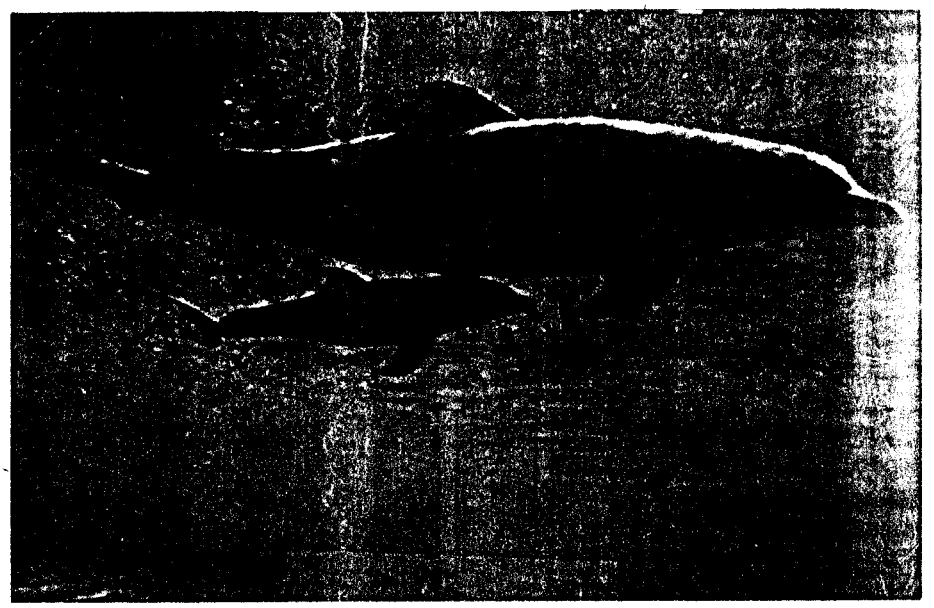


Figure 33

Calves often bump their mother to initiate nursing

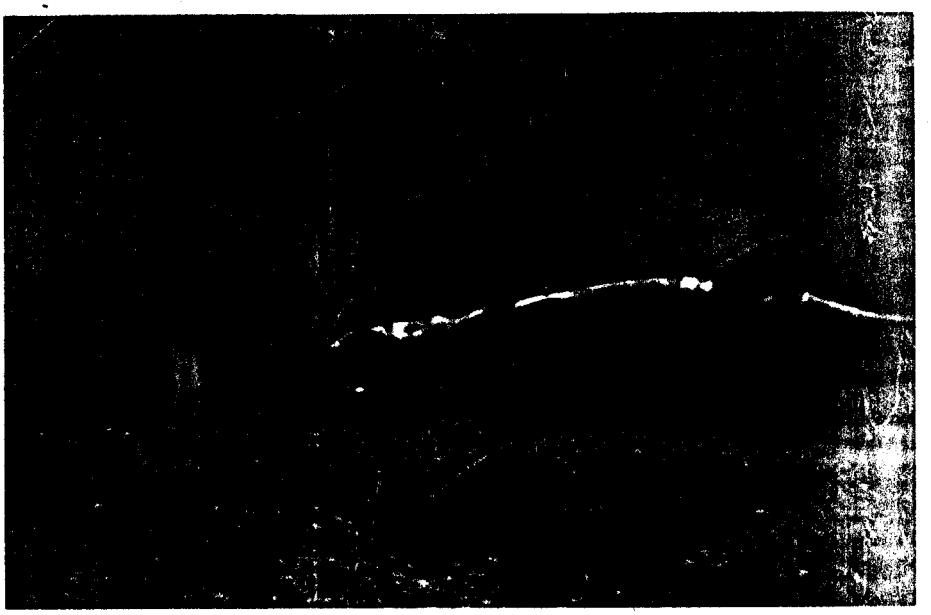
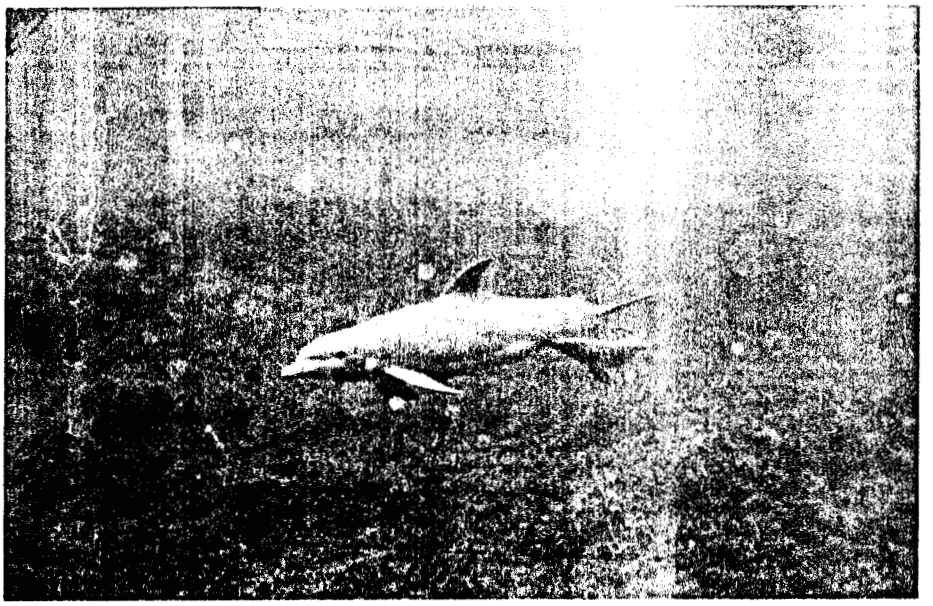


Figure 34

Sometimes mothers stimulate their calves to nurse

Figure 35



Nursing

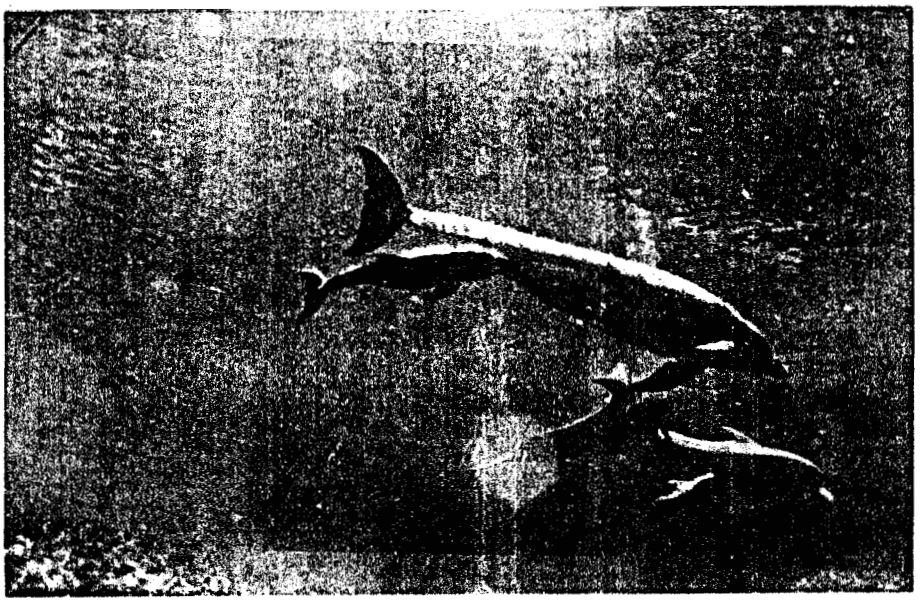


Figure 36

Figure 37

A calf comes up for a breath
while its mother stays to pose

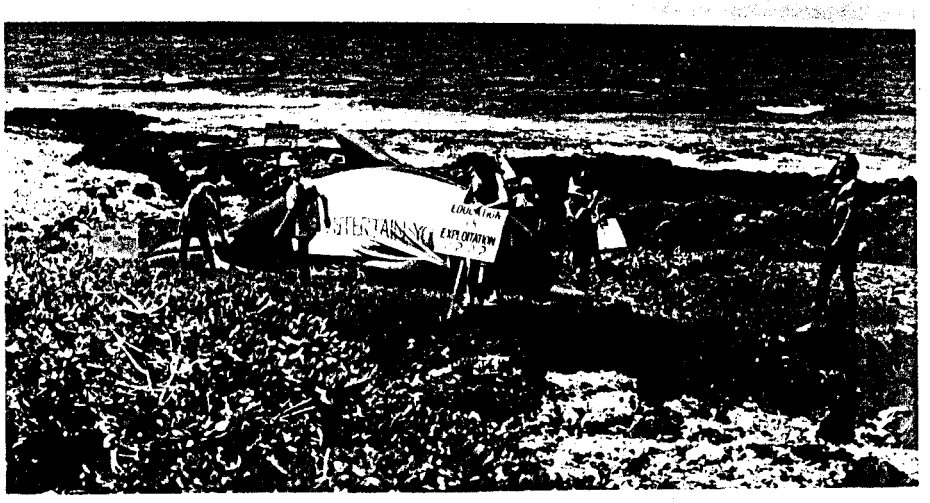


Figure 38

A Greenpeace protest of Dolphin Quest

Figure 39

Kisses

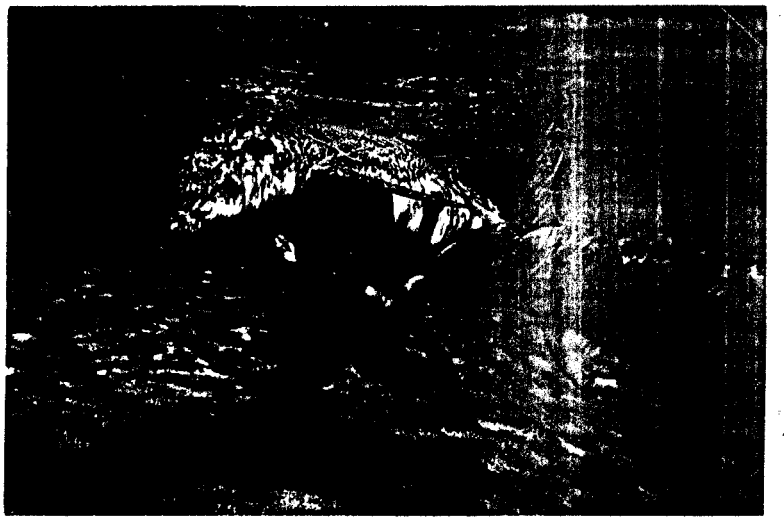


Figure 40

Figure 41

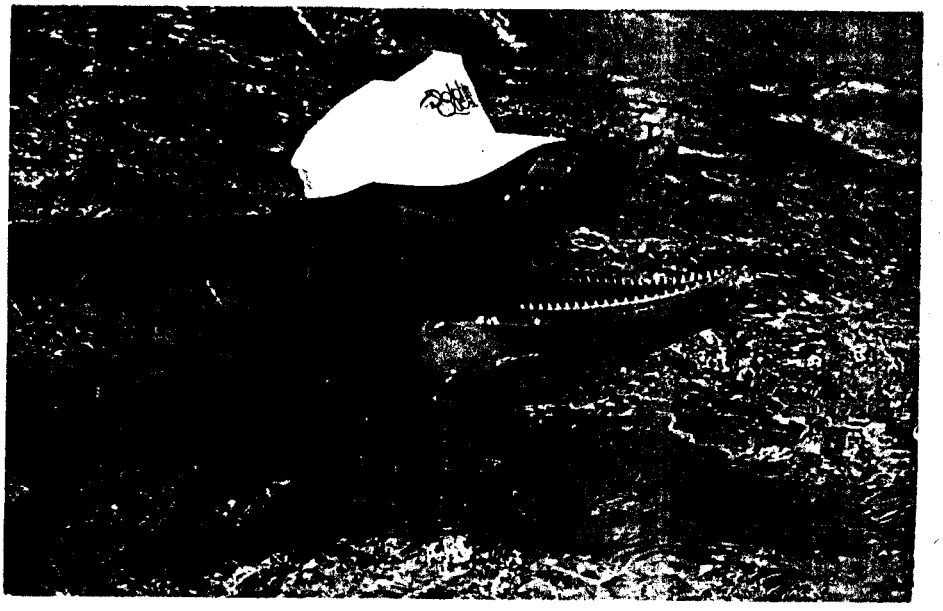
Buddies

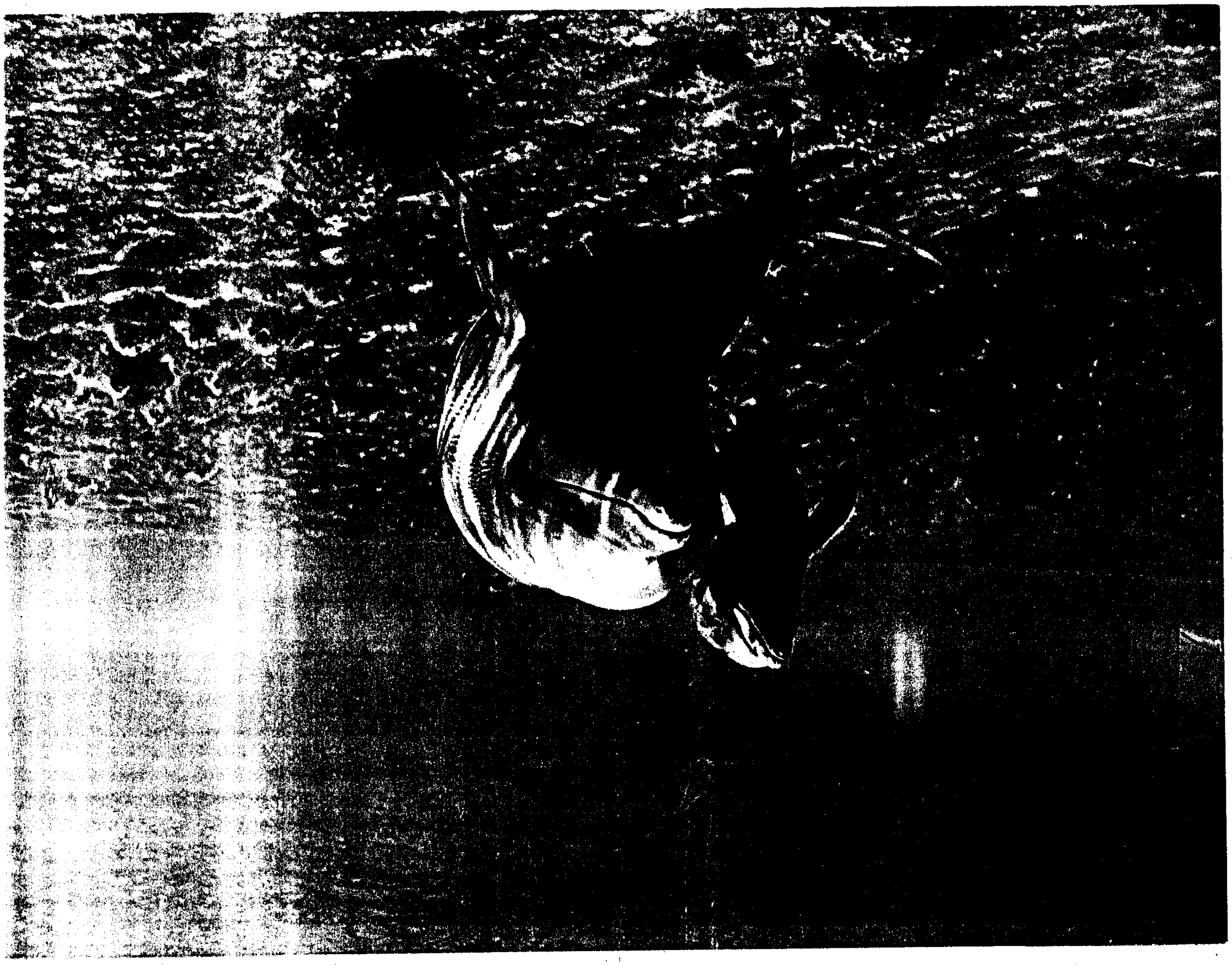
Figure 42

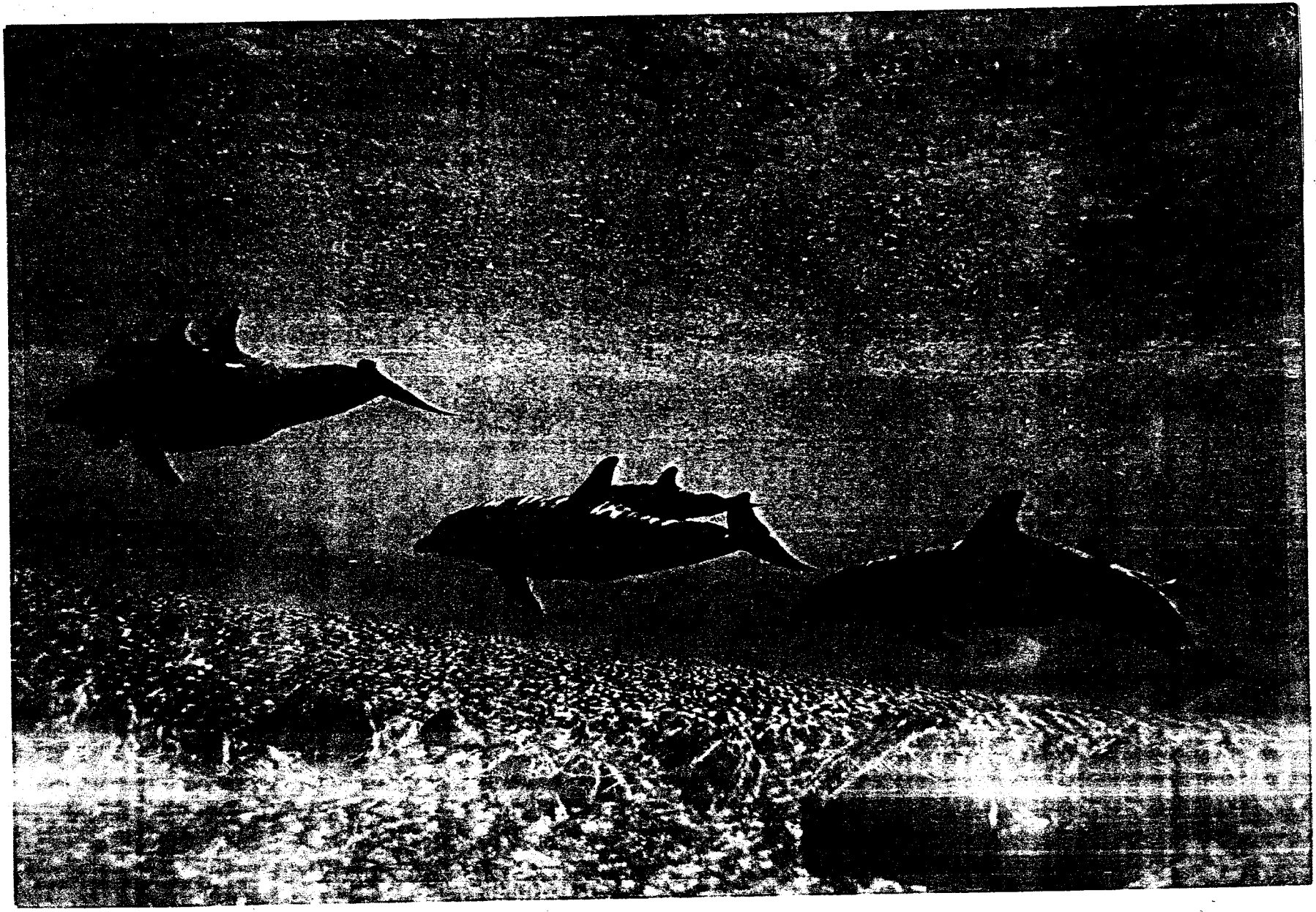
We are family

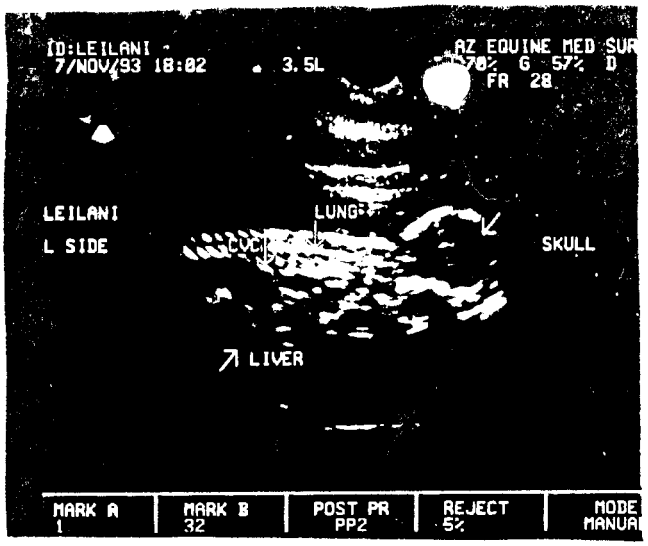
Figure 43

How cute

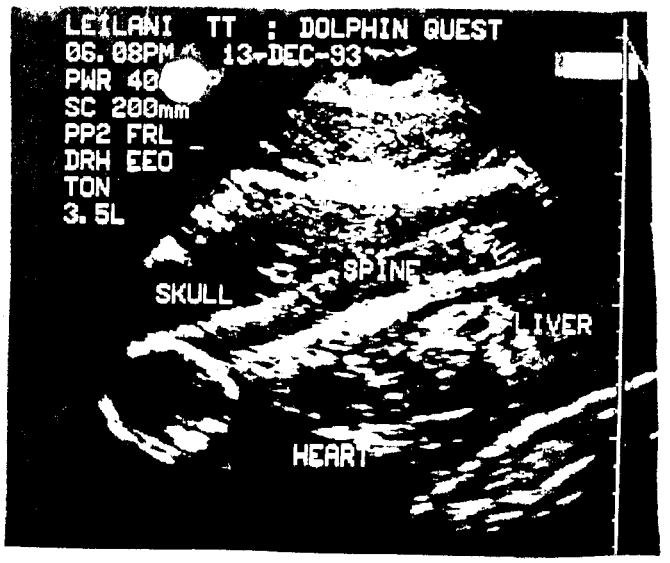




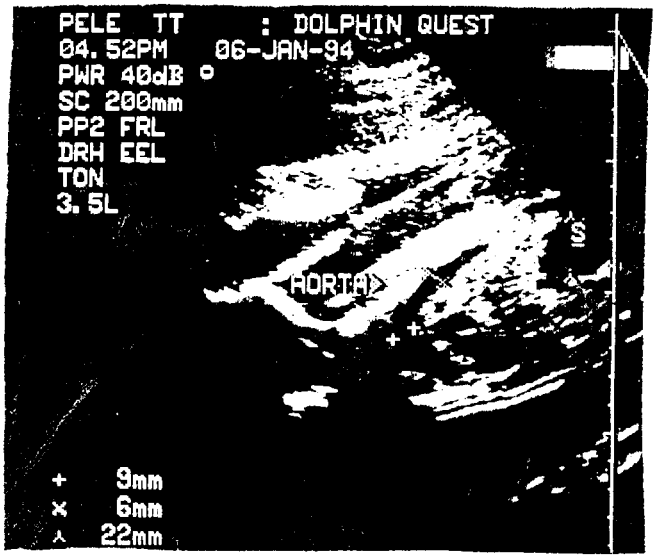




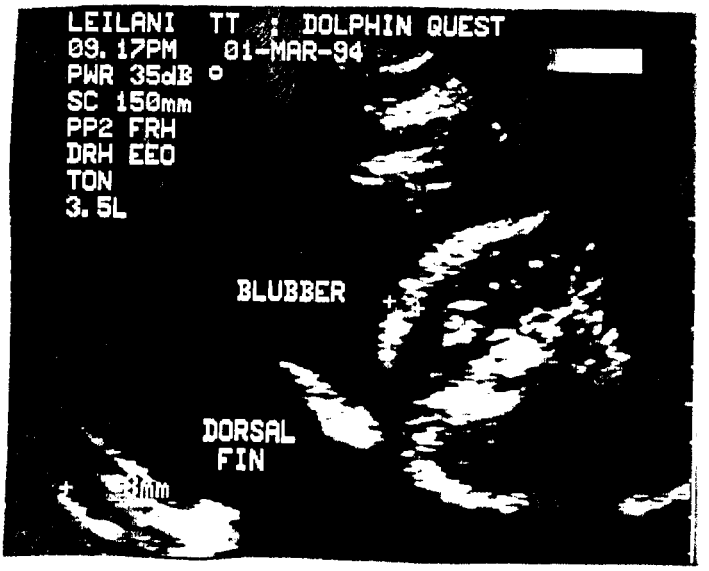
5 months



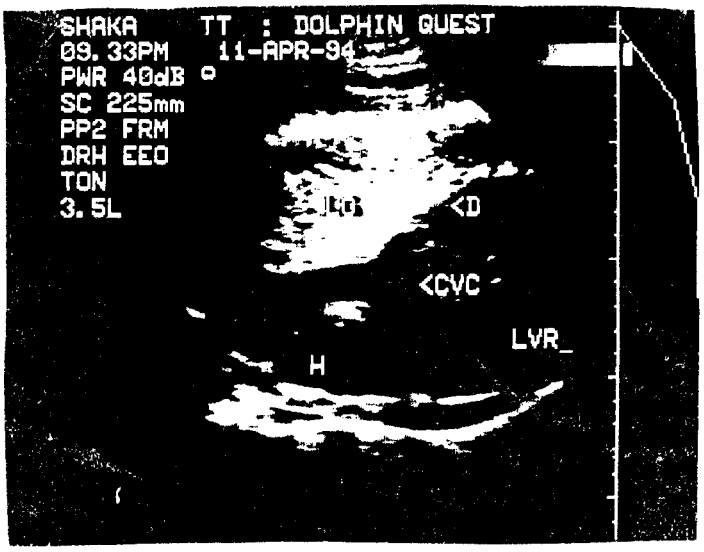
6 months



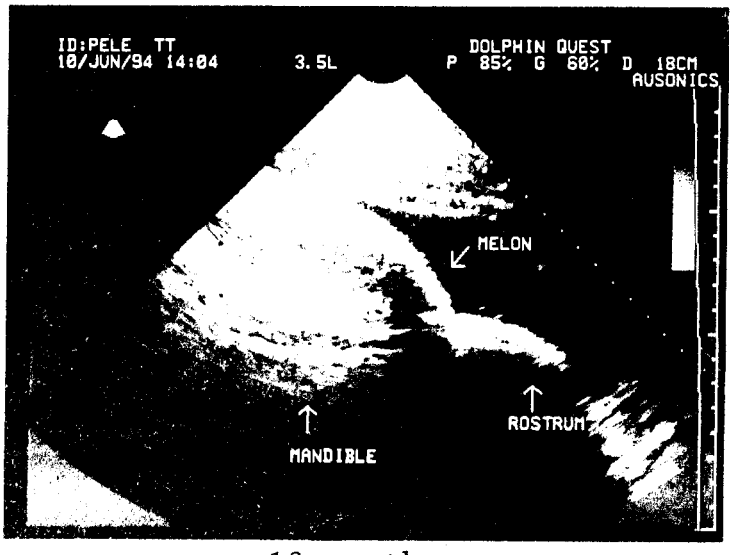
7 months



9 months



10 months



12 months